The brightness for several years past of stars suspected of variability has been furnished to various astronomers. Plates have been sent to the Lick and Amherst Observatories and to the Smithsonian Institution for special investigations. From one of them a new variable star in Aries was discovered by Prof. Schaeberle. It is hoped that this use of our plates may increase in the future. A large number of photographs were taken of the new star in Auriga. An examination of the older photographs showed that the region containing it had been photographed eighteen times from November 3, 1885, to November 2, 1891, and that it was then apparently fainter than the thirteenth magnitude. It appeared upon five plates taken between December 16, 1891, and January 31, 1892. After its discovery it was photographed on sixty-five chart plates and thirty-six spectrum plates, until April 6, when it became too faint to be visible in the encroaching twilight. All of these plates have been carefully studied and measured. Twenty-one charts and fifteen spectrum plates of this object have been taken since its reappearance in September, 1892. On these last plates, the spectrum is shown to resemble that of a planetary nebula.

Many photographs of the lunar eclipse of November 15, 1891, were taken both at Cambridge and at the Boyden observing station near Arequipa, Peru. The examination of these photographs for the detection of a possible lunar satellite led only to a negative result.

The number of photographs taken with the 11-inch Draper telescope is 996. They include 372 spectra of β Aurigæ to determine the law of periodic doubling of the lines. 244 of these images show the lines double so that the separation can be measured. In like manner 208 spectra of ζ Ursæ Majoris have been photographed, and in 49 of them the lines are separated widely enough to be measured. A similar study has been made of the new star in Auriga, of β Lyræ, of 11 Monocerotis, and of some other stars having peculiar spectra. Photographic charts have also been obtained of numerous variable stars, stars having large proper motion, clusters and stars having peculiar spectra to determine their parallax if it is perceptible.

Boyden Department.

In establishing the fund that bears his name, Mr. Boyden desired to secure an astronomical station where the effects due to the atmosphere would be greatly diminished. This has now been successfully accomplished in the Harvard Station at Arequipa, Peru, where the effect of the air is no longer as heretofore the principal obstacle to progress in astronomy. Instead of this the limit is now the size and excellence of our instruments. A great advance would probably be made in our knowledge of the planets, and perhaps of the fixed stars, if a telescope of the largest size could be mounted under such favourable conditions.

This station has continued in charge of Prof. W. H. Pickering. The instruments chiefly employed have been the 13-inch telescope, the 8-inch Bache telescope, and a photographic camera having an aperture of 2½ inches. The first of these instruments has been largely devoted to visual work, for which unusual advantages are afforded by the transparency and steadiness of the air at this station. Many interesting results have been derived from the observations made of the moon and various planets. The observations of the moon relate to Plato and other regions, which have been carefully examined, and also to the systems of bright streaks visible at full moon. The markings of Mercury have been studied, and this investigation appears to confirm Schiaparelli's view that the rotation of Mercury on its axis occupies the same time as its revolution in its orbit. Although this planet appears to have no atmosphere, the markings upon it are very faint compared with those upon the moon. Venus was micrometrically studied near its inferior conjunction with regard to its diameter, polar compression, and the refractive effect of its atmosphere. No permanent markings could be detected. An extensive series of observations was made upon Mars. The relative positions of 92 points upon its surface were determined by the micrometer. More than forty minute black points were discovered, provisionally designated as lakes. The polar compression of the planet was measured, and appeared to be greater than that indicated by theory, which may be due to an excess of cloud in the equatorial regions. The presence of the dark and narrow streaks called canals by Schiaparelli has been confirmed and various measurements of them have been made. The clouds projecting beyond the limb, and terminator, discovered at the Lick Observatory, have been studied, and their height has been found to be at least twenty miles. The relative colours of different portions of the planet have been minutely observed. Two large dark blue areas have been detected, and other portions have been noticed to be subject to gradual changes of colour.

Many new double stars were found in a survey of the heavens south of 30°, between 12h. and 18h. The August occultation of Jupiter was observed both visually and photographically, as was also the new star in Auriga and Swift's comet, the photographs of which showed detail not noticeable in the visual observations.

With the camera, having the aperture 2½ inches, very satisfactory photographs have been obtained of the Magellanic clouds, showing their composition to be partly of stars and partly of nebulous matter; also the spiral structure of the larger of the two clouds.

Meteorological observations are regularly carried on. Stations have been established at Mollendo, 100 feet above sea level, at La Joya, the elevation of which is 4,150 feet, at the observing station, 8,060 feet high, at the Chachani Ravine 16,650 feet high, where numerous miscellaneous observations have been made. Notwithstanding the great height of the last-named station, it can be reached by a mule path, and a hut has been erected where the observers can pass the night. A survey of the Arequipa valley and neighbouring mountains has been made, depending on two separate base lines. The heights of the mountains have been measured, and in some cases the result has been checked by a mercurial barometer.

The Bruce Photographic Telescope.

This instrument, which if successful will be in many respects the most powerful in the world, is now rapidly approaching completion. The eight surfaces of its objective have been ground and polished so that it could be tested on a star. The results were satisfactory, although, of course, no definite opinion can be formed until the final corrections are applied. The focal length proved to be that desired within half of one per cent. Plans have been made and the foundations laid for a one-story brick building with a sliding roof, in which it will be erected during its trial in Cambridge. After this it is proposed to send it to the Arequipa station in Peru.

Photographs have been taken with the transit photometer on 192 evenings, and when clear, throughout the entire night. With this instrument images are obtained of all stars brighter than the sixth magnitude which cross the meridian during the night. The value of this work was illustrated when the new star in Auriga was discovered in February, 1892. It then appeared that this object had been photographed on twelve nights since December 10, 1891, while no trace of it was visible on thirteen plates covering this region and taken before December 2, 1891. The only knowledge that exists of its changes of light during the six weeks in which it remained undiscovered is furnished by these photographs and those taken with the 8-inch telescopes. It was also photographed with the transit photometer on twelve nights after its discovery. Of the forty thousand standard stars of the tenth magnitude about eight thousand have been selected by Miss E. F. Leland during the past year, making eleven thousand in all.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

Oxford.—In the Chemical Department Prof. Odling is lecturing on the glucoses, Mr. Fisher on inorganic chemistry, Dr. Watts on organic chemistry, and Mr. Veley on physical chemistry. There are about sixty students working in the laboratories, and a few of the senior men are engaged in research.

Among the apparatus belonging to the late Duke of Marlborough, presented by the Duchess, are three large spectroscopes by Hilger, one having five prisms, another being a direct vision spectroscope 5 feet 6 inches in length, two balances by Deleuil; a mercury pump by Alvergniat, Dumas' vapour density apparatus, Thomson's electrometer gramme machine, large Rhumkorf coil and a quantity of valuable glass apparatus. There are besides a number of specimens of compounds of rare earths.

The Regius Professor of Medicine has placed his pathological

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laboratory under the direction of the lecturer in Pharmacology. Dr. Ritchie of Edinburgh is carrying out in it some researches in Bacteriology. The Chemical Club started last term by some of the senior men continues to hold meetings weekly for the discussion of recent chemical investigations. Mr. Ingham of Merton is secretary. The meetings are well attended and useful.

Mr. R. T. Günther, B.A., Demy of Magdalen College, has been elected to the Naples Biological Scholarship for the ensuing year.

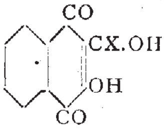
Cambridge.—Mr. H. Bury, Fellow of Trinity College, has been appointed by the Board for Biology and Geology to the use of a table at the Naples Zoological Station for March and April, 1893.

The Boards for Biology and Geology, and for Physics and Chemistry, have reported in favour of extending to Part I. of the Natural Sciences Tripos the plan already adopted for Part II., namely, the substitution of distinct papers in each scientific subject, instead of papers each of which contains questions in all the subjects. They propose that the change come into operation in 1894.

SOCIETIES AND ACADEMIES.

London.

Chemical Society, January 19.—Prof. A. Crum-Brown, President, in the chair.—The following papers were read:—Glucinum, Part I. The preparation of glucina from beryl, by J. Gibson. The methods at present in use for preparing pure glucina from beryl are tedious and difficult to apply on the large scale, as the mineral, which contains but a small quantity of glucinum, has to be reduced to a very fine powder before being treated by the reagents usually employed for the decomposition of refractory silicates. The author has worked out a process which greatly facilitates the preparation of glucina. If the coarsely-ground beryl is heated in an iron vessel with six parts of ammonium hydrogen fluoride, complete decomposition occurs below a red heat. The product contains the aluminium and most of the iron as insoluble fluoride and oxide respectively, together with glucinum fluoride, which dissolves on extraction with water. In order to remove the last traces of iron from crude glucina, advantage is taken of the fact that the precipitation of a lead or mercuric salt by ammonium sulphide effects by mass action the complete separation of small quantities of iron which may be present in the solution.—The determination of the thermal expansion of liquids, by T. E. Thorpe. The author describes various improvements in the ordinary dilatometrical method of determining the thermal expansion of liquids. Amongst these the most important is the application of a device frequently employed in the construction of standard thermometers, and consisting in enlarging the bore of the dilatometer stem at some point. On such an instrument the positions of the 0° and 100° points may be determined irrespectively of its range, and the thermometer, and the column of liquid in the dilatometer stem may be totally immersed in a bath of moderate size, thus doing away with corrections for the emergent columns of the two instruments. The methods of constructing, calibrating, and using the dilatometers are described, together with the baths employed in heating them.—The determination of the thermal expansion and specific volume of certain paraffins and paraffin derivatives, by T. E. Thorpe and L. M. Jones. The authors give the data relating to a number of hydrocarbons, alcohols, ketones, and other derivatives of the paraffins. The results show a fairly satisfactory agreement, in most cases, with the values calculated by Lossen's formula, but all the observed specific volumes, with the exception of that of propionic anhydride, differ considerably from those calculated by means of Kopp's values.—The hydrocarbons derived from dipentene dihydrochloride, by W. A. Tilden and S. Williamson. The dihydrochloride, $C_{10}H_{16}2HCl$ melting at 50°, prepared by the action of moist hydrogen chloride on optically active turpentine, is known to be identical with that obtained from the active citrenes (limonenes) or from inactive "dipentene." On heating it with aniline, an oil is obtained which has hitherto been supposed to consist essentially of dipentene; on oxidising it, however, a certain proportion of aromatic acids is obtained. These acids are not formed on oxidising the active limonenes or pure dipentene with nitric acid; their formation in the previous case is, however, satisfactorily explained by the authors, who find that the dipentene obtained from the dihydrochloride contains large proportions of cymene, terpinene, terpinolene, and a small quantity of a saturated paraffinoid hydrocarbon boiling at about 155°.—Sulphonic derivatives of camphor, by F. S. Kipping and W. J. Pope. The authors have succeeded in preparing camphorsulphonic acid, $C_{10}H_{15}O.SO_3H$, a compound hitherto unknown, by the direct action of anhydrosulphuric acid or chlorosulphonic acid on camphor. The acid is purified by the conversion of its sodium salt into camphorsulphonic chloride, $C_{10}H_{15}O.SO_2Cl$; the latter substance is apparently obtained in optically different modifications which are separated only with considerable difficulty. The sulphonic chloride is readily hydrolysed on boiling with water, yielding the sulphonic acid from which a series of well-defined salts has been obtained. The action of anhydrosulphuric acid on bromocamphor results in the formation of bromocamphorsulphonic acid; this on suitable treatment yields a sulphonic chloride, $C_{10}H_{14}BrO.SO_2Cl$, which crystallises in magnificent colourless octahedra, melting at 136–137°. A bromocamphorsulphonic chloride of similar composition has been previously described by Marsh and Cousins as a "black, semi-crystalline tar;" a repetition of their work shows this to be merely an impure form of the substance now described. The corresponding chlorocamphorsulphonic chloride described by Marsh and Cousins as a "microcrystalline, black solid," crystallises in massive colourless octahedra when pure; it melts at 123–124°, and has a specific rotatory power $[\alpha]_D = + 110°$. The authors describe a number of salts and derivatives of these sulphonic acids.—The preparation of dinitro-α-naphthylamine [$NH_2 : NO_2 : NO_2 = 1 : 2 : 4$] from its acetyl and valeryl derivatives, by R. Meldola and M. O. Forster. Meldola's process of preparing dinitro-α-naphthylamine from α-acetnaphthalide having been questioned, the authors have re-investigated the method and confirm it in all respects; they give full working details of the process, and show that the same product is obtained by the nitration and subsequent hydrolysis of valeronaphthalide.—Thionyl bromide, by J. Hartog and W. E. Sims. Thionyl bromide is obtained as a heavy, crimson liquid by the action of sodium bromide on thionyl chloride; its colour is possibly due to impurity. At 150° the bromide decomposes, yielding bromine and sulphur bromides.—Desulphurisation of the substituted thioureas, by A. E. Dixon. The monosubstituted thioureas are all desulphurised on boiling with an alkaline solution of a lead salt; the same is true of disubstituted thioureas containing benzenoid groups, but not if such groups be absent. The tri- and probably also the tetra-substituted thioureas are not desulphurised under similar conditions. A number of new thioureas are described.—Salts of active and inactive glyceric acid: the influence of metals on the specific rotatory power of active acids, by P. F. Frankland and J. R. Appleyard. The authors have prepared and analysed a number of salts both of inactive and dextro-glyceric acid; the solubilities and specific rotatory powers are also given. Certain remarkable numerical relations apparently exist between the rotations of many of the salts; these should have considerable bearing on the vexed question of multiple rotation, and will be discussed after they have been submitted to a more detailed investigation.—Dibromo-β-lapachone, by S. C. Hooker and A. D. Gray. Monobromo-β-lapachone cannot be converted into dibromo-β-lapachone by the action of bromine alone; the formation of the latter derivative in the preparation of monobromo-β-lapachone from lapachol, is due to the production and subsequent decomposition of an additive compound of monobromo-derivative and hydrogen bromide.—The conversion of para- into ortho-quinone derivatives, by S. C. Hooker. Both in the lapachol and other groups, compounds derived from α-naphthaquinone, of the type represented by formula I., are far more readily converted, by the action of acids, into anhydrides derived from β-naphthaquinone (II.) than into anhydrides of the α-quinone type (III.).



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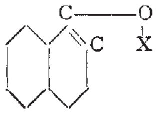

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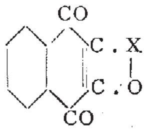

III.

—The nitro-derivatives of phenolphthalein, by J. A. Hall The author has prepared dinitro- and tetranitro-phenolphthalein,

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